UNITED STATES NAVAL OBSERVATORY

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U. S. Naval Observatory, Washington 25, D. C. December 1, 1949

EPHEMERIS OF JUNO, 1949-50

With the primary object of encouraging accurate observations of Ceres, Pallas, Juno, and Vesta, it is intended to publish precise ephemerides of these planets for dates on which they transit the meridian when the Sun is below the horizon, between latitudes 52° north and 34° south. Theoretical studies (see *Astronomical Journal*, **54**, 10, 1948) have indicated that if these four planets are assiduously observed with transit circles the positions of the equinox and equator among the stars can be found with greater accuracy than by observations of any other objects. Photographic observations should be equally valuable for the equinox determination, although they are not suitable for direct determinations of fundamental declinations.

The ephemerides, supposed to be accurate to a few seconds of arc, serve a dual purpose. They serve for easy identification of the planet in the restricted field of view of a transit circle; and, equally for visual and photographic observations, the discordances between the ephemerides and the observations may be analyzed for the determination of differential corrections to the assumed star positions, and to various astronomical constants.

The rectangular equatorial heliocentric coordinates have been obtained by numerical step-by-step integration of their second derivatives with respect to the time, at 20-day intervals. This work is a portion of a joint undertaking, sponsored by the Office of Naval Research, of the U. S. Naval Observatory,

the Yale University Observatory, and the Watson Scientific Computing Laboratory. The actual integrations have been made at the Cincinnati Observatory, while the necessary differential corrections of the orbits have been made in the Office of the American Ephemeris. The results will be published in full in the *Astronomical Papers of the American Ephemeris.*

The geocentric ephemerides will normally be calculated in the British Nautical Almanac Office, and will appear in the *American Ephemeris* and in the British *Nautical Almanac.* Pending the time when the ephemerides can be incorporated in these volumes they will appear in this series of circulars. Owing to the late date at which the heliocentric ephemerides became available it was desirable to expedite the calculation of the geocentric ephemerides as much as possible, and accordingly the data in the present circular were prepared in the Office of the American Ephemeris, while the British Nautical Almanac Office was engaged with Ceres, Pallas, and Vesta.

The apparent ephemeris is immediately comparable with a meridian observation corrected for geocentric parallax. But it is to be specially noted that this ephemeris, in common with the ephemerides of the Sun, Moon, and other planets, is free from the effects of the short-period terms of the nutation, and hence is inconsistent with observed positions derived from clock corrections that are affected by short-period terms, or from nadirs. Meridian observers are cautioned that inattention to this point may result in important errors.

The astrometric ephemeris, obtained by applying the *Reduction* to the apparent ephemeris, is referred to the mean equinox and equator 1950.0, and is affected by the elliptic term of the annual aberration. It is therefore immediately comparable with photographic positions obtained by comparing the planet with catalogue mean places of neighboring stars, it being only necessary to correct the observations for geocentric parallax.

FOR 0^h UNIVERSAL TIME OR GREENWICH CIVIL TIME

Date	Apparent Right Ascension		Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Parallax	Magnitude	Transit, Meridian of Greenwich
	h m s	s	s	° ′ ″	″	′ ″			″		h m
Dec. 1	11 38 41.04	+ 66.20	+ 0.92	− 1 33 10.9	− 306.9	−0 8.0	2.685 722	−10335	3.28	10.3	6 59.9
2	11 39 47.24	65.42	0.89	1 38 17.8	301.0	0 7.7	2.675 387	10395	3.29	10.3	6 57.0
3	11 40 52.66	64.61	0.86	1 43 18.8	295.0	0 7.5	2.664 992	10453	3.30	10.3	6 54.1
4	11 41 57.27	63.80	0.84	1 48 13.8	289.1	0 7.3	2.654 539	10509	3.32	10.3	6 51.2
5	11 43 1.07	62.97	0.81	1 53 2.9	282.8	0 7.1	2.644 030	10564	3.33	10.3	6 48.3
6	11 44 4.04	+ 62.15	+ 0.78	− 1 57 45.7	− 276.6	−0 6.8	2.633 466	−10618	3.34	10.3	6 45.5
7	11 45 6.19	61.29	0.76	2 2 22.3	270.2	0 6.6	2.622 848	10668	3.36	10.3	6 42.6
8	11 46 7.48	60.44	0.73	2 6 52.5	263.7	0 6.4	2.612 180	10719	3.37	10.3	6 39.6
9	11 47 7.92	59.57	0.70	2 11 16.2	257.1	0 6.2	2.601 461	10766	3.38	10.3	6 36.7
10	11 48 7.49	58.68	0.68	2 15 33.3	250.3	0 5.9	2.590 695	10812	3.40	10.3	6 33.8
11	11 49 6.17	+ 57.78	+ 0.65	− 2 19 43.6	− 243.4	−0 5.7	2.579 883	−10855	3.41	10.3	6 30.8
12	11 50 3.95	56.87	0.62	2 23 47.0	236.4	0 5.5	2.569 028	10898	3.43	10.3	6 27.8
13	11 51 0.82	55.94	0.59	2 27 43.4	229.3	0 5.3	2.558 130	10938	3.44	10.3	6 24.8
14	11 51 56.76	54.99	0.57	2 31 32.7	221.9	0 5.0	2.547 192	10975	3.46	10.3	6 21.8
15	11 52 51.75	54.04	0.54	2 35 14.6	214.6	0 4.8	2.536 217	11011	3.47	10.3	6 18.8
16	11 53 45.79	+ 53.07	+ 0.51	− 2 38 49.2	− 206.9	−0 4.6	2.525 206	−11043	3.49	10.3	6 15.7
17	11 54 38.86	52.07	0.48	2 42 16.1	199.3	0 4.3	2.514 163	11073	3.50	10.2	6 12.7
18	11 55 30.93	51.07	0.45	2 45 35.4	191.3	0 4.1	2.503 090	11098	3.52	10.2	6 9.6
19	11 56 22.00	50.05	0.42	2 48 46.7	183.4	0 3.9	2.491 992	11123	3.53	10.2	6 6.5
20	11 57 12.05	49.01	0.39	2 51 50.1	175.3	0 3.6	2.480 869	11142	3.55	10.2	6 3.4
21	11 58 1.06	+ 47.97	+ 0.36	− 2 54 45.4	− 167.0	−0 3.4	2.469 727	−11160	3.56	10.2	6 0.3
22	11 58 49.03	46.91	0.34	2 57 32.4	158.6	0 3.1	2.458 567	11174	3.58	10.2	5 57.2
23	11 59 35.94	45.82	0.31	3 0 11.0	150.2	0 2.9	2.447 393	11185	3.60	10.2	5 54.0
24	12 0 21.76	44.74	0.28	3 2 41.2	141.5	0 2.7	2.436 208	11192	3.61	10.2	5 50.8
25	12 1 6.50	43.64	0.25	3 5 2.7	132.7	0 2.4	2.425 016	11197	3.63	10.2	5 47.6
26	12 1 50.14	+ 42.53	+ 0.22	− 3 7 15.4	− 124.0	−0 2.2	2.413 819	−11198	3.65	10.2	5 44.4
27	12 2 32.67	41.39	0.19	3 9 19.4	114.9	0 2.0	2.402 621	11197	3.66	10.2	5 41.2
28	12 3 14.06	40.26	0.16	3 11 14.3	105.9	0 1.7	2.391 424	11192	3.68	10.2	5 37.9
29	12 3 54.32	39.09	0.13	3 13 0.2	96.7	0 1.5	2.380 232	11184	3.70	10.1	5 34.7
30	12 4 33.41	37.93	0.10	3 14 36.9	87.3	0 1.2	2.369 048	11173	3.72	10.1	5 31.4
31	12 5 11.34	+ 36.75	+ 0.07	− 3 16 4.2	− 77.9	−0 1.0	2.357 875	−11159	3.73	10.1	5 28.1
Jan. 1	12 5 48.09	35.55	0.04	3 17 22.1	68.4	0 0.8	2.346 716	11141	3.75	10.1	5 24.7
2	12 6 23.64	34.34	+ 0.01	3 18 30.5	58.7	0 0.5	2.335 575	11120	3.77	10.1	5 21.4
3	12 6 57.98	33.11	− 0.02	3 19 29.2	48.9	−0 0.3	2.324 455	11097	3.79	10.1	5 18.0
4	12 7 31.09	31.88	0.06	3 20 18.1	39.0	0 0.0	2.313 358	11069	3.80	10.1	5 14.6
5	12 8 2.97	+ 30.62	− 0.09	− 3 20 57.1	− 29.0	+0 0.2	2.302 289	−11039	3.82	10.1	5 11.2
6	12 8 33.59	29.35	0.12	3 21 26.1	18.8	0 0.4	2.291 250	11004	3.84	10.1	5 7.8
7	12 9 2.94	28.08	0.15	3 21 44.9	− 8.5	0 0.7	2.280 246	10968	3.86	10.1	5 4.4
8	12 9 31.02	26.77	0.18	3 21 53.4	+ 1.8	0 0.9	2.269 278	10927	3.88	10.0	5 0.9
9	12 9 57.79	25.45	0.21	3 21 51.6	12.4	0 1.1	2.258 351	10881	3.90	10.0	4 57.4
10	12 10 23.24	+ 24.13	− 0.24	− 3 21 39.2	+ 23.1	+0 1.4	2.247 470	−10834	3.92	10.0	4 53.9
11	12 10 47.37	22.77	0.27	3 21 16.1	33.9	0 1.6	2.236 636	10780	3.93	10.0	4 50.3
12	12 11 10.14	+ 21.42	0.30	3 20 42.2	+ 44.8	0 1.8	2.225 856	−10724	3.95	10.0	4 46.8
13	12 11 31.56		− 0.33	− 3 19 57.4		+0 2.1	2.215 132		3.97	10.0	4 43.2

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Date	Apparent Right Ascension		Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Parallax	Magnitude	Transit, Meridian of Greenwich
	h m s	s	s	° ′ ″	″	′ ″			″		h m
Jan. 13	12 11 31.56	+ 20.04	− 0.33	− 3 19 57.4	+ 55.9	+0 2.1	2.215 132	−10662	3.97	10.0	4 43.2
14	12 11 51.60	18.65	0.36	3 19 1.5	67.0	0 2.3	2.204 470	10597	3.99	10.0	4 39.6
15	12 12 10.25	17.25	0.39	3 17 54.5	78.3	0 2.6	2.193 873	10526	4.01	10.0	4 36.0
16	12 12 27.50	15.84	0.42	3 16 36.2	89.7	0 2.8	2.183 347	10451	4.03	9.9	4 32.3
17	12 12 43.34	14.40	0.45	3 15 6.5	101.1	0 3.0	2.172 896	10371	4.05	9.9	4 28.7
18	12 12 57.74	+ 12.98	− 0.48	− 3 13 25.4	+ 112.7	+0 3.2	2.162 525	−10286	4.07	9.9	4 25.0
19	12 13 10.72	11.53	0.51	3 11 32.7	124.3	0 3.5	2.152 239	10196	4.09	9.9	4 21.2
20	12 13 22.25	10.07	0.54	3 9 28.4	136.0	0 3.7	2.142 043	10102	4.11	9.9	4 17.5
21	12 13 32.32	8.62	0.57	3 7 12.4	147.8	0 3.9	2.131 941	10002	4.13	9.9	4 13.7
22	12 13 40.94	7.15	0.60	3 4 44.6	159.5	0 4.2	2.121 939	9898	4.15	9.9	4 9.9
23	12 13 48.09	+ 5.69	− 0.63	− 3 2 5.1	+ 171.4	+0 4.4	2.112 041	− 9789	4.17	9.8	4 6.1
24	12 13 53.78	4.21	0.66	2 59 13.7	183.2	0 4.6	2.102 252	9675	4.19	9.8	4 2.3
25	12 13 57.99	2.73	0.69	2 56 10.5	195.1	0 4.8	2.092 577	9557	4.21	9.8	3 58.4
26	12 14 0.72	+ 1.25	0.72	2 52 55.4	207.0	0 5.0	2.083 020	9434	4.22	9.8	3 54.5
27	12 14 1.97	− 0.23	0.75	2 49 28.4	218.8	0 5.2	2.073 586	9306	4.24	9.8	3 50.6
28	12 14 1.74	− 1.71	− 0.78	− 2 45 49.6	+ 230.9	+0 5.4	2.064 280	− 9173	4.26	9.8	3 46.7
29	12 14 0.03	3.19	0.81	2 41 58.7	242.7	0 5.6	2.055 107	9036	4.28	9.8	3 42.7
30	12 13 56.84	4.68	0.84	2 37 56.0	254.6	0 5.8	2.046 071	8895	4.30	9.8	3 38.7
31	12 13 52.16	6.16	0.87	2 33 41.4	266.5	0 6.0	2.037 176	8747	4.32	9 7	3 34.7
Feb. 1	12 13 46.00	7.63	0.90	2 29 14.9	278.3	0 6.3	2.028 429	8597	4.34	9.7	3 30.7
2	12 13 38.37	− 9.12	− 0.93	− 2 24 36.6	+ 290.1	+0 6.5	2.019 832	− 8441	4.36	9.7	3 26.6
3	12 13 29.25	10.58	0.96	2 19 46.5	301.9	0 6.6	2.011 391	8280	4.37	9.7	3 22.5
4	12 13 18.67	12.06	0.98	2 14 44.6	313.7	0 6.8	2.003 111	8115	4.39	9.7	3 18.4
5	12 13 6.61	13.51	1.01	2 9 30.9	325.2	0 7.0	1.994 996	7946	4.41	9.7	3 14.3
6	12 12 53.10	14.98	1.04	2 4 5.7	336.9	0 7.2	1.987 050	7770	4.43	9.6	3 10.1
7	12 12 38.12	− 16.42	− 1.07	− 1 58 28.8	+ 348.4	+0 7.4	1.979 280	− 7591	4.45	9.6	3 5.9
8	12 12 21.70	17.87	1.09	1 52 40.4	359.8	0 7.6	1.971 689	7405	4.46	9.6	3 1.7
9	12 12 3.83	19.29	1.12	1 46 40.6	371.2	0 7.8	1.964 284	7216	4.48	9.6	2 57.5
10	12 11 44.54	20.71	1.15	1 40 29.4	382.3	0 7.9	1.957 068	7020	4.50	9.6	2 53.2
11	12 11 23.83	22.11	1.17	1 34 7.1	393.4	0 8.1	1.950 048	6819	4.51	9.6	2 48.9
12	12 11 1.72	− 23.49	− 1.20	− 1 27 33.7	+ 404.2	+0 8.3	1.943 229	− 6613	4.53	9.6	2 44.6
13	12 10 38.23	24.86	1.22	1 20 49.5	414.9	0 8.4	1.936 616	6402	4.54	9.5	2 40.3
14	12 10 13.37	26.20	1.25	1 13 54.6	425.5	0 8.6	1.930 214	6186	4.56	9.5	2 36.0
15	12 9 47.17	27.52	1.27	1 6 49.1	435.6	0 8.7	1.924 028	5964	4.57	9.5	2 31.6
16	12 9 19.65	28.82	1.30	0 59 33.5	445.7	0 8.9	1.918 064	5738	4.59	9.5	2 27.2
17	12 8 50.83	− 30.07	− 1.32	− 0 52 7.8	+ 455.4	+0 9.0	1.912 326	− 5507	4.60	9.5	2 22.8
18	12 8 20.76	31.31	1.35	0 44 32.4	464.8	0 9.2	1.906 819	5270	4.61	9.5	2 18.4
19	12 7 49.45	32.51	1.37	0 36 47.6	474.0	0 9.3	1.901 549	5031	4.63	9 5	2 13.9
20	12 7 16.94	33.67	1.39	0 28 53.6	482.8	0 9.4	1.896 518	4786	4.64	9.4	2 9.4
21	12 6 43.27	34.81	1.41	0 20 50.8	491.3	0 9.6	1.891 732	4537	4.65	9.4	2 5.0
22	12 6 8.46	− 35.89	− 1.44	− 0 12 39.5	+ 499.4	+0 9.7	1.887 195	− 4284	4.66	9.4	2 0.5
23	12 5 32.57	36.96	1.46	− 0 4 20.1	507.2	0 9.8	1.882 911	4028	4.67	9.4	1 55.9
24	12 4 55.61	− 37.97	1.48	+ 0 4 7.1	+ 514.6	0 9.9	1.878 883	− 3768	4.68	9.4	1 51.4
25	12 4 17.64		− 1.50	+ 0 12 41.7		+0 10.0	1.875 115		4.69	9.4	1 46.8

FOR 0^h UNIVERSAL TIME OR GREENWICH CIVIL TIME

Date	Apparent Right Ascension		Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Paral-lax	Magni-tude	Transit, Meridian of Green-wich
	h m s	s	s	° ′ ″	″	′ ″			″		h m
Feb. 25	12 4 17.64	− 38.94	− 1.50	+ 0 12 41.7	+ 521.6	+0 10.0	1.875 115	− 3505	4.69	9.4	1 46.8
26	12 3 38.70	39.87	1.52	0 21 23.3	528.2	0 10.1	1.871 610	3238	4.70	9.4	1 42.2
27	12 2 58.83	40.75	1.54	0 30 11.5	534.4	0 10.2	1.868 372	2968	4.71	9.3	1 37.6
28	12 2 18.08	41.60	1.56	0 39 5.9	540.1	0 10.3	1.865 404	2695	4.72	9.3	1 33.0
Mar. 1	12 1 36.48	42.40	1.57	0 48 6.0	545.5	0 10.4	1.862 709	2421	4.72	9.3	1 28.4
2	12 0 54.08	− 43.14	− 1.59	+ 0 57 11.5	+ 550.5	+0 10.5	1.860 288	− 2142	4.73	9.3	1 23.8
3	12 0 10.94	43.84	1.61	1 6 22.0	554.8	0 10.5	1.858 146	1862	4.73	9.3	1 19.1
4	11 59 27.10	44.51	1.63	1 15 36.8	559.0	0 10.6	1.856 284	1580	4.74	9.3	1 14.5
5	11 58 42.59	45.11	1.64	1 24 55.8	562.5	0 10.7	1.854 704	1295	4.74	9.3	1 9.8
6	11 57 57.48	45.66	1.66	1 34 18.3	565.6	0 10.7	1.853 409	1008	4.75	9.2	1 5.1
7	11 57 11.82	− 46.18	− 1.68	+ 1 43 43.9	+ 568.3	+0 10.8	1.852 401	− 719	4.75	9.2	1 0.4
8	11 56 25.64	46.64	1.69	1 53 12.2	570.6	0 10.8	1.851 682	428	4.75	9.2	0 55.7
9	11 55 39.00	47.04	1.70	2 2 42.8	572.2	0 10.9	1.851 254	− 134	4.75	9.2	0 51.0
10	11 54 51.96	47.39	1.72	2 12 15.0	573.5	0 10.9	1.851 120	+ 159	4.75	9.2	0 46.3
11	11 54 4.57	47.69	1.73	2 21 48.5	574.2	0 11.0	1.851 279	457	4.75	9.2	0 41.6
12	11 53 16.88	− 47.92	− 1.74	+ 2 31 22.7	+ 574.5	+0 11.0	1.851 736	+ 754	4.75	9.2	0 36.9
13	11 52 28.96	48.12	1.76	2 40 57.2	574.2	0 11.0	1.852 490	1053	4.75	9.2	0 32.2
14	11 51 40.84	48.24	1.77	2 50 31.4	573.4	0 11.0	1.853 543	1353	4.75	9.2	0 27.4
15	11 50 52.60	48.31	1.78	3 0 4.8	572.0	0 11.0	1.854 896	1653	4.74	9.2	0 22.7
16	11 50 4.29	48.32	1.79	3 9 36.8	570.3	0 11.0	1.856 549	1954	4.74	9.2	0 18.0
17	11 49 15.97	− 48.27	− 1.80	+ 3 19 7.1	+ 568.0	+0 11.0	1.858 503	+ 2254	4.73	9.2	0 13.2
18	11 48 27.70	48.17	1.81	3 28 35.1	565.1	0 11.0	1.860 757	2556	4.73	9.2	0 8.5
19	11 47 39.53	48.00	1.82	3 38 0.2	561.7	0 11.0	1.863 313	2855	4.72	9.2	{0 3.8 / 23 58.0}
20	11 46 51.53	47.78	1.82	3 47 21.9	558.0	0 10.9	1.866 168	3154	4.72	9.2	23 54.3
21	11 46 3.75	47.51	1.83	3 56 39.9	553.7	0 10.9	1.869 322	3453	4.71	9.2	23 49.6
22	11 45 16.24	− 47.17	− 1.84	+ 4 5 53.6	+ 548.8	+0 10.9	1.872 775	+ 3749	4.70	9.2	23 44.9
23	11 44 29.07	46.79	1.84	4 15 2.4	543.7	0 10.9	1.876 524	4045	4.69	9.2	23 40.2
24	11 43 42.28	46.35	1.85	4 24 6.1	538.1	0 10.8	1.880 569	4338	4.68	9.3	23 35.5
25	11 42 55.93	45.86	1.85	4 33 4.2	531.9	0 10.8	1.884 907	4629	4.67	9.3	23 30.8
26	11 42 10.07	45.31	1.86	4 41 56.1	525.5	0 10.8	1.889 536	4919	4.66	9.3	23 26.1
27	11 41 24.76	− 44.73	− 1.86	+ 4 50 41.6	+ 518.6	+0 10.7	1.894 455	+ 5205	4.64	9.3	23 21.4
28	11 40 40.03	44.10	1.87	4 59 20.2	511.4	0 10.7	1.899 660	5489	4.63	9.3	23 16.8
29	11 39 55.93	43.41	1.87	5 7 51.6	503.8	0 10.6	1.905 149	5771	4.62	9.4	23 12.1
30	11 39 12.52	42.70	1.87	5 16 15.4	495.9	0 10.6	1.910 920	6049	4.60	9.4	23 7.5
31	11 38 29.82	41.93	1.87	5 24 31.3	487.7	0 10.5	1.916 969	6325	4.59	9.4	23 2.8
Apr. 1	11 37 47.89	− 41.12	− 1.88	+ 5 32 39.0	+ 479.2	+0 10.4	1.923 294	+ 6596	4.58	9.4	22 58.2
2	11 37 6.77	40.29	1.88	5 40 38.2	470.4	0 10.4	1.929 890	6866	4.56	9.4	22 53.6
3	11 36 26.48	39.42	1.88	5 48 28.6	461.4	0 10.3	1.936 756	7133	4.54	9.5	22 49.1
4	11 35 47.06	38.51	1.88	5 56 10.0	452.1	0 10.2	1.943 889	7396	4.53	9.5	22 44.5
5	11 35 8.55	37.57	1.88	6 3 42.1	442.6	0 10.2	1.951 285	7656	4.51	9.5	22 39.9
6	11 34 30.98	− 36.60	− 1.88	+ 6 11 4.7	+ 432.9	+0 10.1	1.958 941	+ 7913	4.49	9.5	22 35.4
7	11 33 54.38	35.60	1.88	6 18 17.6	423.0	0 10.0	1.966 854	8167	4.47	9.5	22 30.9
8	11 33 18.78	− 34.56	1.87	6 25 20.6	+ 412.8	0 9.9	1.975 021	+ 8417	4.46	9.6	22 26.4
9	11 32 44.22		− 1.87	+ 6 32 13.4		+0 9.9	1.983 438		4.44	9.6	22 21.9

FOR 0^h UNIVERSAL TIME OR GREENWICH CIVIL TIME

Date	Apparent Right Ascension		Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Parallax	Magnitude	Transit, Meridian of Greenwich
	h m s	s	s	° ′ ″	″	′ ″			″		h m
Apr. 9	11 32 44.22	− 33.50	− 1.87	+ 6 32 13.4	+ 402.5	+0 9.9	1.983 438	+ 8665	4.44	9.6	22 21.9
10	11 32 10.72	32.40	1.87	6 38 55.9	392.0	0 9.8	1.992 103	8908	4.42	9.6	22 17.4
11	11 31 38.32	31.30	1.87	6 45 27.9	381.4	0 9.7	2.001 011	9149	4.40	9.6	22 12.9
12	11 31 7.02	30.14	1.87	6 51 49.3	370.6	0 9.6	2.010 160	9384	4.38	9.6	22 8.5
13	11 30 36.88	28.99	1.86	6 57 59.9	359.6	0 9.5	2.019 544	9616	4.36	9.7	22 4.1
14	11 30 7.89	− 27.79	− 1.86	+ 7 3 59.5	+ 348.6	+0 9.4	2.029 160	+ 9844	4.34	9.7	21 59.7
15	11 29 40.10	26.59	1.86	7 9 48.1	337.4	0 9.4	2.039 004	10067	4.32	9.7	21 55.3
16	11 29 13.51	25.37	1.85	7 15 25.5	326.2	0 9.3	2.049 071	10287	4.29	9.7	21 51.0
17	11 28 48.14	24.12	1.85	7 20 51.7	314.8	0 9.2	2.059 358	10500	4.27	9.7	21 46.6
18	11 28 24.02	22.86	1.84	7 26 6.5	303.5	0 9.1	2.069 858	10712	4.25	9.8	21 42.3
19	11 28 1.16	− 21.60	− 1.84	+ 7 31 10.0	+ 292.0	+0 9.0	2.080 570	+10916	4.23	9.8	21 38.0
20	11 27 39.56	20.32	1.83	7 36 2.0	280.6	0 8.9	2.091 486	11117	4.21	9.8	21 33.8
21	11 27 19.24	19.02	1.82	7 40 42.6	269.2	0 8.8	2.102 603	11312	4.19	9.8	21 29.5
22	11 27 0.22	17.73	1.82	7 45 11.8	257.7	0 8.8	2.113 915	11504	4.16	9.9	21 25.3
23	11 26 42.49	16.43	1.81	7 49 29.5	246.3	0 8.7	2.125 419	11690	4.14	9.9	21 21.1
24	11 26 26.06	− 15.12	− 1.81	+ 7 53 35.8	+ 234.8	+0 8.6	2.137 109	+11871	4.12	9.9	21 16.9
25	11 26 10.94	13.80	1.80	7 57 30.6	223.5	0 8.5	2.148 980	12048	4.10	9.9	21 12.7
26	11 25 57.14	12.50	1.80	8 1 14.1	212.1	0 8.4	2.161 028	12220	4.07	9.9	21 8.6
27	11 25 44.64	11.19	1.79	8 4 46.2	200.9	0 8.3	2.173 248	12386	4.05	10.0	21 4.5
28	11 25 33.45	9.88	1.78	8 8 7.1	189.7	0 8.2	2.185 634	12550	4.03	10.0	21 0.4
29	11 25 23.57	− 8.58	− 1.77	+ 8 11 16.8	+ 178.7	+0 8.2	2.198 184	+12707	4.00	10.0	20 56.3
30	11 25 14.99	7.28	1.77	8 14 15.5	167.6	0 8.1	2.210 891	12861	3.98	10.0	20 52.2
May 1	11 25 7.71	5.98	1.76	8 17 3.1	156.7	0 8.0	2.223 752	13010	3.96	10.1	20 48.2
2	11 25 1.73	4.70	1.75	8 19 39.8	145.8	0 7.9	2.236 762	13156	3.93	10.1	20 44.2
3	11 24 57.03	3.41	1.74	8 22 5.6	135.2	0 7.8	2.249 918	13297	3.91	10.1	20 40.2
4	11 24 53.62	± 2.14	− 1.74	+ 8 24 20.8	+ 124.5	+0 7.8	2.263 215	+13434	3.89	10.1	20 36.2
5	11 24 51.48	− 0.87	1.73	8 26 25.3	113.9	0 7.7	2.276 649	13569	3.87	10.1	20 32.3
6	11 24 50.61	+ 0.39	1.72	8 28 19.2	103.6	0 7.6	2.290 218	13697	3.84	10.2	20 28.4
7	11 24 51.00	1.64	1.71	8 30 2.8	93.1	0 7.5	2.303 915	13824	3.82	10.2	20 24.5
8	11 24 52.64	2.90	1.70	8 31 35.9	83.0	0 7.5	2.317 739	13946	3.80	10.2	20 20.6
9	11 24 55.54	+ 4.14	− 1.70	+ 8 32 58.9	+ 72.7	+0 7.4	2.331 685	+14065	3.77	10.2	20 16.7
10	11 24 59.68	5.37	1.69	8 34 11.6	62.8	0 7.3	2.345 750	14178	3.75	10.2	20 12.8
11	11 25 5.05	6.60	1.68	8 35 14.4	52.7	0 7.3	2.359 928	14287	3.73	10.3	20 9.0
12	11 25 11.65	7.81	1.67	8 36 7.1	42.9	0 7.2	2.374 215	14394	3.71	10.3	20 5.2
13	11 25 19.46	9.02	1.66	8 36 50.0	33.2	0 7.1	2.388 609	14496	3.68	10.3	20 1.4
14	11 25 28.48	+ 10.22	− 1.66	+ 8 37 23.2	+ 23.5	+0 7.1	2.403 105	+14593	3.66	10.3	19 57.6
15	11 25 38.70	11.40	1.65	8 37 46.7	14.1	0 7.0	2.417 698	14686	3.64	10.3	19 53.9
16	11 25 50.10	12.57	1.64	8 38 0.8	+ 4.6	0 7.0	2.432 384	14776	3.62	10.3	19 50.2
17	11 26 2.67	13.74	1.63	8 38 5.4	− 4.6	0 6.9	2.447 160	14862	3.60	10.4	19 46.5
18	11 26 16.41	14.89	1.62	8 38 0.8	13.8	0 6.8	2.462 022	14942	3.57	10.4	19 42.8
19	11 26 31.30	+ 16.02	− 1.62	+ 8 37 47.0	− 22.7	+0 6.8	2.476 964	+15020	3.55	10.4	19 39.1
20	11 26 47.32	17.14	1.61	8 37 24.3	31.7	0 6.7	2.491 984	15093	3.53	10.4	19 35.5
21	11 27 4.46	+ 18.26	1.60	8 36 52.6	− 40.3	0 6.7	2.507 077	+15162	3.51	10.4	19 31.8
22	11 27 22.72		− 1.59	+ 8 36 12.3		+0 6.6	2.522 239		3.49	10.5	19 28.2

FOR 0^h UNIVERSAL TIME OR GREENWICH CIVIL TIME

Date	Apparent Right Ascension		Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Parallax	Magnitude	Transit, Meridian of Greenwich
	h m s	s	s	° ′ ″	″	′ ″			″		h m
May 22	11 27 22.72	+ 19.34	− 1.59	+ 8 36 12.3	− 49.0	+0 6.6	2.522 239	+15227	3.49	10.5	19 28.2
23	11 27 42.06	20.43	1.58	8 35 23.3	57.5	0 6.6	2.537 466	15289	3.47	10.5	19 24.6
24	11 28 2.49	21.49	1.58	8 34 25.8	65.8	0 6.6	2.552 755	15347	3.45	10.5	19 21.1
25	11 28 23.98	22.54	1.57	8 33 20.0	74.0	0 6.5	2.568 102	15400	3.43	10.5	19 17.5
26	11 28 46.52	23.57	1.56	8 32 6.0	82.0	0 6.5	2.583 502	15452	3.41	10.5	19 14.0
27	11 29 10.09	+ 24.59	− 1.55	+ 8 30 44.0	− 89.9	+0 6.4	2.598 954	+15498	3.39	10.5	19 10.4
28	11 29 34.68	25.59	1.55	8 29 14.1	97.7	0 6.4	2.614 452	15543	3.37	10.6	19 6.9
29	11 30 0.27	26.57	1.54	8 27 36.4	105.2	0 6.4	2.629 995	15583	3.35	10.6	19 3.4
30	11 30 26.84	27.54	1.53	8 25 51.2	112.8	0 6.3	2.645 578	15622	3.33	10.6	18 59.9
31	11 30 54.38	28.49	1.52	8 23 58.4	120.1	0 6.3	2.661 200	15657	3.31	10.6	18 56.5
June 1	11 31 22.87	+ 29.43	− 1.52	+ 8 21 58.3	− 127.4	+0 6.2	2.676 857	+15689	3.29	10.6	18 53.0
2	11 31 52.30	30.35	1.51	8 19 50.9	134.4	0 6.2	2.692 546	15720	3.27	10.6	18 49.6
3	11 32 22.65	31.26	1.50	8 17 36.5	141.5	0 6.2	2.708 266	15747	3.25	10.6	18 46.2
4	11 32 53.91	32.17	1.50	8 15 15.0	148.3	0 6.2	2.724 013	15771	3.23	10.7	18 42.8
5	11 33 26.08	33.04	1.49	8 12 46.7	155.2	0 6.1	2.739 784	15794	3.21	10.7	18 39.4
6	11 33 59.12	+ 33.92	− 1.48	+ 8 10 11.5	− 161.8	+0 6.1	2.755 578	+15812	3.19	10.7	18 36.0
7	11 34 33.04	34.79	1.47	8 7 29.7	168.4	0 6.1	2.771 390	15829	3.18	10.7	18 32.6
8	11 35 7.83	35.63	1.47	8 4 41.3	174.8	0 6.1	2.787 219	15842	3.16	10.7	18 29.3
9	11 35 43.46	36.47	1.46	8 1 46.5	181.3	0 6.0	2.803 061	15853	3.14	10.7	18 26.0
10	11 36 19.93	37.29	1.45	7 58 45.2	187.5	0 6.0	2.818 914	15860	3.12	10.7	18 22.7
11	11 36 57.22	+ 38.10	− 1.45	+ 7 55 37.7	− 193.6	+0 6.0	2.834 774	+15865	3.10	10.8	18 19.4
12	11 37 35.32	38.90	1.44	7 52 24.1	199.7	0 6.0	2.850 639	15867	3.09	10.8	18 16.1
13	11 38 14.22	39.69	1.43	7 49 4.4	205.7	0 6.0	2.866 506	15865	3.07	10.8	18 12.8
14	11 38 53.91	40.47	1.43	7 45 38.7	211.5	0 6.0	2.882 371	15862	3.05	10.8	18 9.5
15	11 39 34.38	41.22	1.42	7 42 7.2	217.2	0 6.0	2.898 233	15854	3.04	10.8	18 6.3
16	11 40 15.60	+ 41.97	− 1.42	+ 7 38 30.0	− 222.9	+0 6.0	2.914 087	+15845	3.02	10.8	18 3.0
17	11 40 57.57	42.71	1.41	7 34 47.1	228.4	0 6.0	2.929 932	15833	3.00	10.8	17 59.8
18	11 41 40.28	43.44	1.40	7 30 58.7	233.8	0 5.9	2.945 765	15817	2.99	10.9	17 56.6
19	11 42 23.72	44.14	1.40	7 27 4.9	239.1	0 5.9	2.961 582	15798	2.97	10.9	17 53.4
20	11 43 7.86	44.84	1.39	7 23 5.8	244.3	0 5.9	2.977 380	15778	2.96	10.9	17 50.2
21	11 43 52.70	+ 45.53	− 1.39	+ 7 19 1.5	− 249.4	+0 5.9	2.993 158	+15755	2.94	10.9	17 47.0
22	11 44 38.23	46.19	1.38	7 14 52.1	254.3	0 5.9	3.008 913	15729	2.93	10.9	17 43.9
23	11 45 24.42	46.86	1.38	7 10 37.8	259.2	0 5.9	3.024 642	15700	2.91	10.9	17 40.7
24	11 46 11.28	47.50	1.37	7 6 18.6	264.0	0 5.9	3.040 342	15670	2.89	10.9	17 37.6
25	11 46 58.78	48.13	1.36	7 1 54.6	268.7	0 5.9	3.056 012	15637	2.88	10.9	17 34.4
26	11 47 46.91	+ 48.75	− 1.36	+ 6 57 25.9	− 273.1	+0 5.9	3.071 649	+15603	2.87	11.0	17 31.3
27	11 48 35.66	49.36	1.35	6 52 52.8	277.7	0 5.9	3.087 252	15567	2.85	11.0	17 28.2
28	11 49 25.02	49.96	1.35	6 48 15.1	282.0	0 5.9	3.102 819	15528	2.84	11.0	17 25.1
29	11 50 14.98	50.55	1.34	6 43 33.1	286.3	0 6.0	3.118 347	15489	2.82	11.0	17 22.0
30	11 51 5.53	51.12	1.34	6 38 46.8	290.4	0 6.0	3.133 836	15446	2.81	11.0	17 18.9
July 1	11 51 56.65	+ 51.69	− 1.33	+ 6 33 56.4	− 294.6	+0 6.0	3.149 282	+15404	2.79	11.0	17 15.8
2	11 52 48.34		− 1.33	+ 6 29 1.8		+0 6.0	3.164 686		2.78	11.0	17 12.8

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